DOCUMENT RESUME

ED 423 402 CE 077 158

TITLE	Wisconsin's Model Academic Standards for Technology Education. Bulletin No. 9006.
INSTITUTION	Wisconsin State Dept. of Public Instruction, Madison.
ISBN	ISBN-1-57337-066-5
PUB DATE	1998-00-00
NOTE	29p.
AVAILABLE FROM	Publication Sales, Wisconsin Dept. of Public Instruction, Drawer 179, Milwaukee, WI 53293-0179; Tel: 800-243-8782 (Toll Free).
PUB TYPE	Guides - Non-Classroom (055)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Academic Standards; Career Development; Competency Based Education; Elementary Secondary Education; *Employment Potential; Integrated Curriculum; *Job Skills; *Science and Society; State Curriculum Guides; *State Standards; Statewide Planning; Technological Advancement; Technology; *Technology Education
IDENTIFIERS	*Wisconsin

ABSTRACT

This document contains standards for the academic content of the Wisconsin K-12 curriculum in the area of technology education. Developed by task forces of educators, parents, board of education members, and employers and employees, the standards cover content, performance, and proficiency areas. The first part of the guide is an introduction that defines the academic standards, explains how and why they were developed, and suggests ways teachers can use the standards, relate them to all students, and apply them across the curriculum. It is followed by an overview of technology education and the standards for the following topics: nature of technology, systems, human ingenuity, and the impact of technology. Standards for each topic are organized into the skills and knowledge students should be able to demonstrate by the end of grades 4, 8, and 12. A glossary defines 10 terms. (KC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 423 402

CE

Technology Education

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

Minor changes have been made to improve reproduction quality.

Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

G Doyle

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

1

2

BEST COPY AVAILABLE

Wisconsin's Model Academic Standards for Technology Education

John D. Fortier
Assistant State Superintendent
Division for Learning Support: Instructional Services

Bryan D. Albrecht
Director
Lifework Education Team

Susan M. Grady
Director
Content and Learning Team

Kevin D. Miller
Consultant
Technology Education

Kenneth J. Starkman
Consultant
Technology Education

John T. Benson
State Superintendent
Wisconsin Department of Public Instruction
Madison, Wisconsin

This publication is available from

Publication Sales
Wisconsin Department of Public Instruction
Drawer 179
Milwaukee WI 53293-0179
(800) 243-8782

Bulletin No. 9006

ISBN 1-57337-066-5

©1998 by Wisconsin Department of Public Instruction

The Wisconsin Department of Public Instruction does not discriminate on the basis of sex, race, religion, age, national origin, ancestry, creed, pregnancy, marital or parental status, sexual orientation or physical, mental, emotional or learning disability.

Printed on recycled paper.

Table of Contents

Letter from the State Superintendent v

Acknowledgments vii

Introduction xi

Message to Teachers xv

Overview of Technology Education 1

A. Nature of Technology 4

B. Systems 6

C. Human Ingenuity 8

D. Impact of Technology 10

Glossary of Terms 12

Bibliography 13

A Letter From the State Superintendent

To the Citizens of Wisconsin:

Wisconsin has long been a model for other states in terms of education quality. However, the world is rapidly becoming a more complex place. As a result, we must expect greater academic achievement from our children today if they are to be adequately prepared for the challenges of tomorrow.

The only way to ensure that Wisconsin's students have the skills and abilities to be successful in this rapidly changing technological world is to set clear, high academic standards that describe precisely what today's students must learn and be able to do in order to be successful in their adult lives. This is why we focused our efforts over the past two years creating model academic standards in all subject areas. While Wisconsin's Model Academic Standards do demand more of our students, we are confident that our students are equal to the task.

These model academic standards represent the work of a task force made up of people from diverse backgrounds. Educators, parents, and business people produced the academic content and performance standards in this document. Drafts were subjected to public engagement in which many additional people offered input.

It must be stressed that these standards are not intended to limit local districts. Instead they are a model to be met or exceeded. Our hope is that the standards will shape teaching and learning in Wisconsin's more than 2000 school buildings. The standards will define the criteria by which one can judge the quality of education programs. While many schools already have clearly defined high academic standards, many others may wish to review and perhaps change their learning goals and teaching methods.

Standards logically provide the foundation for testing; and, testing results are a critical barometer of both student and teacher success. Local tests that are well-aligned to the standards are a clear indicator of students' preparation for future education, civic responsibility, and meaningful employment.

In closing, I want to commend the members of the task force who gave freely of their time to produce the standards in this document. Finally, the citizens of Wisconsin must be thanked for devoting their time and effort to the development of the final draft of Wisconsin's Model Academic Standards.

John T. Benson

John T. Benson
State Superintendent

Acknowledgments

Wisconsin's Model Academic Standards for Technology Education would not have been possible without the efforts of many people. Members of the task force, writing team, and reactor group gave their time and expertise in developing these standards. In addition, their employing agencies generously granted them time to work on this initiative.

Lois Abel
Elementary Teacher
Poynette Elementary School

Butch Bretzel
Mathematics Teacher
St. Francis High School

Sharon Cloud
Member
Wisconsin Indian Education Association

Sandi Cornelius
Member
Wisconsin Indian Education Association

Carol Diehl
Retired Media Specialist
Manawa

Jim Dimock
Principal
Parkview Elementary School
Chippewa Falls

Cindy Eiling
Wisconsin Manufacturers and Commerce
Madison

Robert Gilpatrick
District Administrator
Verona School District

Alan Gomez*
Technology Education Teacher
West High School
Madison

Marlene Hoffmann
Director
Wisconsin Association of School Boards
Jackson

Robert Hollon, Associate Professor
UW-Eau Claire

Dr. Suzanne Hotter
District Administrator
Watertown School District

Steve Johnston*
Technology Education Teacher
Logan High School
LaCrosse

Derald Kettlewell
Director
Wisconsin Association of School Boards
Greenfield

Jim Kasum
Chairperson, Department of
Educational Computing
Cardinal Stritch University
Milwaukee

Joseph Kmoch
Systems Manager
Washington High School
Milwaukee

Don LaBonte
English/Speech Teacher
Brookfield East High School
Elmbrook School District

Dick Larson
Technology Education Teacher
South Middle School
Eau Claire

Pat Lewno
Second Vice President
Wisconsin PTA
Racine

Sherry Macaul
Professor
UW-Eau Claire

Also on Writing Team

Tom Martin
President
Wisconsin School Counselor Association
Bayfield High School

Maxine Miller
Family and Consumer Education Teacher
Fall Creek High School

Robert Peters
Technology Education Teacher
Lincoln High School
Wisconsin Rapids

Bonnie Prohaska
Elementary Teacher
Stephens Elementary School
Madison

Dan Richardson
Social Studies Teacher
East Troy High School

Bill Rockwell
Education Consultant
Wisconsin Technical College System
Madison

Bill Schang
Professor
Ripon College

Jane Shibilski
President-Elect
Wisconsin PTA
Wausau

Robert Scidmore*
Technology Staff Development Specialist
Eau Claire Public Schools

Dennis Skurulsky*
Technology Education Department Chair
School to Work Director
Waukesha School District

Damon Smith
Technology Education Teacher
Memorial High School
Eau Claire

Richard Sorensen
Instructional Media and Technology Consultant
Department of Public Instruction

Sandra Stanton
President-Elect
Wisconsin School Counselor Association
Putman Heights Elementary School
Eau Claire

Dr. Leonard Sterry*
Professor
University of Wisconsin-Stout
Menomonie

Michael Streibel
Associate Dean
University of Wisconsin-Madison

Pat Thorshakken
Family and Consumer Education Teacher
Whitehall High School

Dr. Kenneth Welty*
Professor
University of Wisconsin-Stout
Menomonie

Russ Wittkop
Staff Representative
Wisconsin State AFL-CIO
Milwaukee

Writing Team

Kenneth Bremer
Technology Education Teacher
O'Keeffe Middle School
Madison

Margery Brutscher-Collins
Technology Education Teacher
Tremper High School
Kenosha

Dale M. Hanson
Technology Education Teacher
East High School
Appleton

Robert Hendricks
Professor
Communication, Education and
Training Department
University of Wisconsin-Stout
Menomonie

Also on Writing Team

Carol Kettner
Elementary Teacher
Woodland Elementary School
Barron

John Peter
Elementary Teacher
Spooner Elementary School

Mike Roth
Technology Education Teacher
Monona Grove High School

Fred Schroedl
Curriculum Specialist
Milwaukee Public Schools

Dawn Theelke
Elementary Teacher
Blaine Elementary
Superior

Katherine Weber
Technology Education Teacher
Franklin High School

Jerry Williams
Technology Education Teacher
East High School
West Bend

Special thanks to Greg Doyle, Kathy Addie, Donna Collingwood, Amy French, Philomena Hanna, Victoria Horn, Beverly Kniess, Sandi Ness, Terri Otto, Edy Paske, and Tammy Wylesky for their valuable contributions to this publication. Their talents and assistance are sincerely appreciated.

Introduction

Defining the Academic Standards

What are academic standards? Academic standards specify what students should know and be able to do, what they might be asked to do to give evidence of standards, and how well they must perform. They include content, performance, and proficiency standards.

— Content standards refer to *what* students should know and be able to do.

— Performance standards tell *how* students will show that they are meeting a standard.

— Proficiency standards indicate *how well* students must perform.

Why are academic standards necessary? Standards serve as rigorous goals for teaching and learning. Setting high standards enables students, parents, educators, and citizens to know what students should have learned at a given point in time. The absence of standards has consequences similar to lack of goals in any pursuit. Without clear goals, students may be unmotivated and confused.

Contemporary society is placing immense academic demands on students. Clear statements about what students must know and be able to do are essential to ensure that our schools offer students the opportunity to acquire the knowledge and skills necessary for success.

Why are state-level academic standards important? Public education is a state responsibility. The state superintendent and legislature must ensure that all children have equal access to high quality education programs. At a minimum, this requires clear statements of what all children in the state should know and be able to do as well as evidence that students are meeting these expectations. Furthermore, academic standards form a sound basis on which to establish the content of a statewide assessment system.

Why does Wisconsin need its own academic standards? Historically, the citizens of Wisconsin are very serious and thoughtful about education. They expect and receive very high performance from their schools. While educational needs may be similar among states, values differ. Standards should reflect the collective values of the citizens and be tailored to prepare young people for economic opportunities that exist in Wisconsin, the nation, and the world.

Developing the Academic Standards

Who wrote the academic standards and what resources were used? Academic standards for the non-state-assessed subjects were drafted by task forces appointed by the state superintendent. The task forces consisted of educators, parents, board of education members, and business and industry people. After reviewing national standards in the subject area, standards from other states, and standards from local Wisconsin school districts, each task force diligently and thoughtfully composed the academic standards for its respective subject.

How was the public involved in the standards process? Public input is crucial to the success of implementing high-quality standards. It was absolutely essential that the final academic standards reflect the values of Wisconsin's citizens.

Forums, focus groups, and input on the discussion drafts of the academic standards were used for getting citizens' ideas. Drafts of the standards were widely available throughout the state—including the DPI home page available on the Internet. All input received serious consideration.

Using the Academic Standards

Must a district adopt Wisconsin's Model Academic Standards? Adopting Wisconsin's Model Academic Standards is voluntary, not mandatory. By law, however, districts must have academic standards in place by August 1, 1998, in reading and writing, geography and history, mathematics, and science. Districts may adopt the model state standards, or standards from other sources, or develop their own standards. Although not required by law to have standards in the other subjects, districts may choose to adopt or develop academic standards in those areas as well.

How will local districts use the academic standards? Districts may use the academic standards as guides for developing local grade-by-grade curriculum. Implementing standards may require some school districts to upgrade school and district curriculums. In some cases, this may result in significant changes in instructional methods and materials, local assessments, and professional development opportunities for the teaching and administrative staff.

Do academic standards in the vocational areas mean that districts need to offer electives in these subjects at the elementary and middle school levels? Most subjects are developmental—they build upon previously learned knowledge and skills. In addition, subjects include knowledge and skills that are of great value to all students regardless of their future life and career plans.

The model academic content and performance standards developed for the vocational areas include subject matter that all students should learn. In many cases, students are already learning these in elementary and middle school. The academic standards for vocational areas are a means to assist teachers in knowing if they are meeting the needs of students by preparing them for future opportunities.

With the academic standards in vocational areas at the fourth and eighth grade levels, it is not expected new elective courses will need to be instituted. Current middle and high school vocational teachers are encouraged to work with elementary and middle school teachers from other subject areas to connect curriculum experiences.

Why do some of the subjects also benchmark for "emphasis students" as well as for grades 4, 8, and 12? Most subjects include knowledge and skills that are of great value to all students. Identified knowledge and skills should be part of the performance standards for all students. In addition, some vocational subjects include more in-depth knowledge and skills that are necessary for specific applications. Students should be able to pursue courses requiring in-depth knowledge and skills that are consistent with their life and career plans. The standards directed at "emphasis students" address a much higher level of performance in that subject.

How do DPI skill standards fit with the academic standards currently being developed? Academic content, performance, and proficiency standards focus on expectations about what all students should know and be able to do, how they will show that they have met the standards, and at what level or quality of performance.

Skill standards include content from multiple disciplines and define what productive workers in an occupational cluster or industry sector need to know and be able to do.

What is the difference between academic standards and curriculum? Standards are statements about what students should know and be able to do, what they might be asked to do to give evidence of learning, and how well they should be expected to know or do it. Curriculum is the program devised by local school districts used to prepare students to meet standards. It consists of activities and lessons at each grade level, instructional materials, and various instructional techniques. In short, standards define what is to be learned at certain points in time, and from a broad perspective, what performances will be accepted as evidence that the learning has occurred. Curriculum specifies the details of the day-to-day schooling at the local level.

What is the link between statewide academic standards and statewide testing? Statewide academic standards in mathematics, English language arts, science, and social studies determine the scope of state-

wide testing. While these standards are much broader in content than any single Wisconsin Student Assessment System (WSAS) test, they do describe the range of knowledge and skills that may appear on the tests. If content does not appear in the academic standards, it will not be part of a WSAS test. The statewide standards clarify what must be studied to prepare for WSAS tests. If students have learned all of the material indicated by the standards in the assessed content areas, they should do very well on the state tests.

Relating the Academic Standards to All Students

Parents and educators of students with disabilities, with limited English proficiency (LEP), and with accelerated needs may ask why academic standards are important for their students. Academic standards serve as a valuable basis for establishing meaningful goals as part of each student's developmental progress and demonstration of proficiency. The clarity of academic standards provides meaningful, concrete goals for the achievement of students with disabilities, LEP, and accelerated needs consistent with all other students.

Academic standards may serve as the foundation for individualized programming decisions for students with disabilities, LEP, and accelerated needs. While the vast majority of students with disabilities and LEP should be expected to work toward and achieve these standards, accommodations and modifications to help these students reach the achievement goals will need to be individually identified and implemented. For students with disabilities, these decisions are made as part of their individualized education program (IEP) plans. Accelerated students may achieve well beyond the academic standards and move into advanced grade levels or into advanced coursework.

Clearly, these academic standards are for all students. As our state assessments are aligned with these standards and school districts adopt, adapt, or develop their own standards and multiple measures for determining proficiencies of students, greater accountability for the progress of all students can be assured. In Wisconsin this means all students reaching their full individual potential, every school being accountable, every parent a welcomed partner, every community supportive, and no excuses.

Applying the Academic Standards Across the Curriculum

When community members and employers consider what they want citizens and employees to know and be able to do, they often speak of broad areas of applied knowledge such as communication, thinking, problem-solving, and decision-making. These areas connect or go beyond the mastery of individual subject areas. As students apply their knowledge both within and across the various curricular areas, they develop the concepts and complex thinking of educated persons.

Community members need these skills to function as responsible citizens. Employers prize those employees who demonstrate these skills because they are people who can continue learning and connect what they have learned to the requirements of a job. College and university faculty recognize the need for these skills as the means of developing the level of understanding that separates the expert from the beginner.

Teachers in every class should expect and encourage the development of these shared applications, both to promote the learning of the subject content and to extend learning across the curriculum. These applications fall into five general categories:

1) **Application of the Basics**

2) **Ability to Think**
   - — Problem-solving
   - — Informed decision-making
   - — Systems thinking
   - — Critical, creative, and analytical thinking
   - — Imagining places, times, and situations different from one's own
   - — Developing and testing a hypothesis
   - — Transferring learning to new situations

3) **Skill in Communication**
   - — Constructing and defending an argument
   - — Working effectively in groups
   - — Communicating plans and processes for reaching goals
   - — Receiving and acting on instructions, plans, and models
   - — Communicating with a variety of tools and skills

4) **Production of Quality Work**
   - — Acquiring and using information
   - — Creating quality products and performances
   - — Revising products and performances
   - — Developing and pursuing positive goals

5) **Connections with Community**
   - — Recognizing and acting on responsibilities as a citizen
   - — Preparing for work and lifelong learning
   - — Contributing to the aesthetic and cultural life of the community
   - — Seeing oneself and one's community within the state, nation, and world
   - — Contributing and adapting to scientific and technological change

A Message to Teachers

When writing the standards care was taken to write them in a clear, direct manner avoiding jargon. In some instances, however, technological terms could not be avoided. A glossary has been provided at the back of this booklet.

Teaching technology education to elementary, middle, and high school students is extremely important. Elementary, middle, and high school teachers play an important role in the development of technologically literate citizens.

Elementary School (Grades K-5)

The technology education standards should be integrated throughout the elementary curriculum. Teaching technology provides tremendous opportunity for students to apply knowledge through design and the use of materials and processes to solve real problems systematically and to gain new knowledge from what they have learned. Critical thinking, team work, research and development, experimentation, and testing help deliver the goals of the elementary curriculum and enrich the entire learning and teaching process. Elementary educators provide students with opportunities to develop their own perceptions of technology and its interrelationships with the world in which we live.

Elementary education teachers can teach technology if they have a basic understanding of the discipline. Technology teacher education programs, workshops, conferences, and in-service opportunities help to better prepare teachers for this opportunity. The International Technology Education Association and the Wisconsin Technology Education Association are two professional organizations for technology teachers. The Wisconsin Department of Public Instruction has two technology education consultants and the University of Wisconsin–Stout houses a technology education teacher education program. A licensed technology education teacher in your school district may be an excellent resource.

Middle School (Grades 6-8)

Technology education should be part of the core curriculum for all middle school students. The middle level standards are best delivered through a series of exploratory technology courses in grades six through eight. Middle school teachers should emphasize the role technology plays in our day-to-day lives and the impact it has on individuals, societies and the environment. Learning should be activity-based and designed to facilitate individual interests and learning styles. A school may elect to have a team of teachers develop learning activities so curriculum and learning can be linked across disciplines to provide more opportunities for students to apply what they have learned.

High School (Grades 9-12)

Technology education in the high school must go beyond constructing physical objects. Students must develop an understanding of the nature of technology, technological systems, design and ingenuity, and the impact of technology. Course offerings must include elements to ensure all students will graduate technologically literate. More in-depth courses may be offered to those students interested in engineering, materials science, electronics, production systems, biotechnology, energy and transportation systems, and construction systems. Teamwork and collaboration are important parts of the learning process in high school technology courses. Another method to prepare students for post-secondary education includes school-supervised work experiences.

Overview of Technology Education

It has been said that we live in permanent whitewater, a time in which change is a constant, a time when schools and other institutions must respond if change is to be managed. The 21st century will bring new technologies that will be more complex, mature, and versatile than those we utilize today. The realities of what is on today's drawing boards will undoubtedly reshape how we work, how we recreate, how we view the world, how we learn, and most importantly, what we must learn. We are now in a position to exercise options that were beyond our comprehension a mere decade ago. How we educate a generation that can comprehend, cope with, and direct these technologies is a challenge that schools must respond to. *The need for literacy about this human effort, that is, the development and use of technical means, is the role of technology education.* (Lauda, n.d.)

Technology education standards specify both what students should know and what they should be able to do with technology. The standards are not a test or a curriculum. They indicate the knowledge and the processes essential to technology that should be taught—and learned—in school. Many disciplines outline the connections their standards have to technology. The ultimate goal is to improve the process of teaching and learning.

Technology education takes learning with technology one step farther than other disciplines. Technology becomes a school subject, and the ultimate goal is technological literacy for everyone. A student involved in a technology education curriculum would experience

- designing, developing, and utilizing technological systems
- open-ended, problem-based design activities
- applying technological knowledge and processes to real world experiences using up-to-date resources
- working individually as well as in a team to solve problems

Many people purchase a new VCR only to find out it has a wide array of options that are nice, but may never be used. The use of technological tools, and the design of their systems, is evidence of a widening gap in the knowledge, capability, and confidence of the average citizen and that of inventors, researchers, and implementors who continue to revolutionize the technological world. Not only is it logical and necessary for the developers to have advanced technological capability, but it is also necessary for the general public to be technologically literate. A technologically literate person understands and appreciates the importance of fundamental technological developments and can better contribute to the global society.

Through technology, people have changed the world. In the drive to satisfy needs and wants, people have developed and improved ways to communicate, travel, build structures, make products, cure disease, and provide food. Each technological advance builds on prior developments. Each advance leads to additional possibilities, problems, and refinements. The acceleration of technological change inspires and thrills some people, but confuses and even alienates others. This phenomenon is the Nature of Technology.

The Nature of Technology is just one component of the fabric that contains the essence of technology. The other three components are: Systems, a group of interrelated components designed to collectively achieve a desired goal or goals; Human Ingenuity, challenges requiring students to draw upon their knowledge and abilities to use resources to solve technological problems; and Impact of Technology, carefully weighing the benefits and risks of technologies, and making informed decisions about technological issues.

Technology affects other academic disciplines such as the humanities and the sciences. In the Walt Disney animated children's classic, *The Lion King*, the story line talks of how the "circle of life" involves all animals and their reliance on each other so as not to disrupt the delicate balance of nature. Technology has a similar cyclical type of relationship with science. The science community seeks to understand nature and technology seeks to design a human solution. As scientists theorize and understand more about our physical and biological world, technologists take that understanding and design a human solution. This, in turn, opens up new areas of research for science. Thus, the cyclical relationship continues. Mathematics becomes a vital tool that is used universally by both science and technology.

Technology will not solve all of the problems in the future. In fact, technology may create some. If our children develop and use technology in the context of the community's and nation's goals and values, they will continue to offer each other even more ways to work, enjoy leisure, communicate, and organize their lives.

A. NATURE OF TECHNOLOGY

CONTENT STANDARD

Students in Wisconsin will understand that technology is an extension of human capability.

Rationale: "As long as there have been people, there has been technology. Indeed, the techniques of shaping tools are taken as the chief evidence of the beginning of human culture. On the whole, technology has been a powerful force in the development of civilization, all the more so as its link with science has been forged. Technology—like language, ritual, values, commerce, and the arts—is an intrinsic part of a cultural system and it both shapes and reflects the system's values. In today's world, technology is a complex social enterprise that includes not only research, design, and crafts but also finance, manufacturing, management, labor, marketing, and maintenance.

"In the broadest sense, technology extends our abilities to change the world: to cut, shape, or put together materials; to move things from one place to another; to reach farther with our hands, voices, and senses. We use technology to try to change the world to suit us better. The changes may relate to survival needs such as food, shelter, or defense, or they may relate to human aspirations such as knowledge, art, or control. But the results of changing the world are often complicated and unpredictable. They can include unexpected benefits, unexpected costs, and unexpected risks—any of which may fall on different social groups at different times. Anticipating the effects of technology is therefore as important as advancing its capabilities."—Science for All Americans

Benchmarks for Science Literacy, Project 2061, American Association for the Advancement of Science, Oxford University Press, New York, 1993, p.41-57.

PERFORMANCE STANDARDS

▶ *BY THE END OF GRADE 4 STUDENTS WILL:*

A.4.1 Discover that technology is know-how that extends human capabilities to solve problems or enhances the quality of life while science helps us to discover what is natural

A.4.2 Realize that all humans engage in technological activities; therefore, everyone is a technologist

A.4.3 Conclude that technology cannot always satisfy every human want and need

A.4.4 Explain that the purpose of a designed object is to solve a problem or enhance the quality of life

A.4.5 Determine that humans have always developed tools to communicate, build, move things, and reshape their environment to meet their wants and needs

A.4.6 Illustrate how technology has evolved throughout human history

A.4.7 Research how different groups in the world use technology

A.4.8 Use tools to observe, measure, make things, and transfer information

A.4.9 Predict possible evolution scenarios for a modern piece of technology

BY THE END OF GRADE 8 STUDENTS WILL:

A.8.1 Show that technology has allowed us to further the efforts of science and, in turn, science has enabled us to develop better technology

A.8.2 Explain the need for and application of knowledge and skills from other disciplines when engaging in technological activities

A.8.3 Identify and contrast the connections and differences between technology and other disciplines

A.8.4 Determine that technological knowledge is valuable but not always available to everyone on an equal basis

A.8.5 Analyze how cultures and groups value technology differently and how these values influence the development and acceptance of technology

A.8.6 Analyze the distribution and access of various technologies and explain how inequities occur because of social and political systems

A.8.7 Discover that human will or desire can lead to the design of new technology in order to seize an opportunity or solve a problem

BY THE END OF GRADE 12 STUDENTS WILL:

A.12.1 Contrast the increasing complexities of technology with its ease of use

A.12.2 Understand that humans are faced with moral and ethical issues because technology is enabling very significant modifications to the natural world

A.12.3 Explain why decisions regarding the use of technology are dependent on the situation, application, or perception of the group using it

A.12.4 Explore the way in which human adaptive technological systems interact with ideological and sociological systems

A.12.5 Portray how a society may not be able to exercise full control over their technological systems

A.12.6 Use accepted methods of forecasting and projecting to develop scenarios of future technology needs and uses

A.12.7 Explain how scientific and technological research can contribute to improved quality of life and a better standard of living

B. SYSTEMS

CONTENT STANDARD

Students in Wisconsin will recognize that systems are made up of individual components and that each component affects the operation of the system and its relationship to other systems.

Rationale: Technological systems have always been a part of daily life. Recently, they have become more apparent because of their sophistication and influence. By coordinating and processing resources, these systems help to provide products and services such as food, clothing, shelter, entertainment, health care, security, and other necessities and comforts of life. Though often subtle, these systems are everywhere in our world and, without exception, they impact all of us.

PERFORMANCE STANDARDS

BY THE END OF GRADE 4 STUDENTS WILL:

B.4.1 Identify and categorize systems that provide food, clothing, shelter, entertainment, health care, security, and other necessities and comforts of life

B.4.2 Identify the parts of a system and explain how the parts working together allow the system to do things the individual parts are unable to do alone

B.4.3 Describe various reasons systems may fail; such as, overuse, lack of proper maintenance or management, improper design, or other natural or unnatural factors that may occur

B.4.4 Explain how systems depend on a variety of resources to produce a desirable outcome

B.4.5 Identify and compare enterprises as technological systems

B.4.6 Follow a set of instructions to produce a product using appropriate tools and materials

B.4.7 Explain how tools and materials are used to provide services and create products

BY THE END OF GRADE 8 STUDENTS WILL:

B.8.1 Compare and contrast the function of each of the following common elements of technological systems: inputs, processes, outputs, and feedback

B.8.2 Analyze various systems and identify the ways in which they are controlled to produce a desired outcome

B.8.3 Identify potential sources of failure in a system; such as, defective parts, maintenance needs, a large number of complex components, or use in applications beyond its original purpose

B.8.4 Discover that resources are essential; they must be used effectively to produce a desired outcome, and outputs from one system may be inputs to another system

B.8.5 Evaluate large and complex systems to determine the ways in which they are creations of human ingenuity

B.8.6 Identify all the resources necessary for a given system; analyze how the use of the resources will be affected by consideration for cost, availability, appropriate application, and regard for the environment

B.8.7 Compare and contrast the use of tools, processes, and materials in diverse applications; such as, auto production, health care, food processing , laboratory research, and space exploration

BY THE END OF GRADE 12 STUDENTS WILL:

B.12.1 Identify and explain the ways technological systems have evolved and will continue to evolve to satisfy human needs and desires

B.12.2 Demonstrate how systems are planned, organized, designed, built, and controlled

B.12.3 Explain how enterprises apply technological systems for generating wealth by providing goods and services

B.12.4 Illustrate how resources are essential to technological activity but that their availability and quality vary extensively throughout the world

B.12.5 Assess the impact new and improved products and services have had on the quality of life; explain how the development of new tools, materials, and processes is necessary to maintain and improve high productivity and quality

B.12.6 Show how new knowledge is usually, by design or otherwise, an outcome of technological activity that contributes to the exponential growth of technological knowledge

B.12.7 Explain how new and higher quality products require new and higher quality materials and processing techniques

B.12.8 Select and apply appropriate processes to transform information into its most useful format

C. HUMAN INGENUITY

CONTENT STANDARD

Students in Wisconsin will be able to define problems, gather information, explore options, devise a solution, evaluate the outcome, and communicate the results.

Rationale: Humans have historically been involved in technological activity. We use our knowledge, physical ability, and technology to solve problems and seize opportunity. The design, development, and use of technological items is a direct result of human resourcefulness. When a new technology is introduced and opportunities are acted upon, the technology begins to evolve bringing more opportunity and still more problems to solve.

Technological items and processes are inspired by a need, an end result, or just out of human curiosity. Students must be challenged to solve technological problems by drawing upon their knowledge to plan a solution, select the proper resources and processes, create, and then evaluate the solution.

PERFORMANCE STANDARDS

▶ *BY THE END OF GRADE 4 STUDENTS WILL:*

C.4.1 Examine products and processes and communicate how that product or process solved a human need or want

C.4.2 Show how modern inventions and innovations have evolved as a result of new knowledge and technology

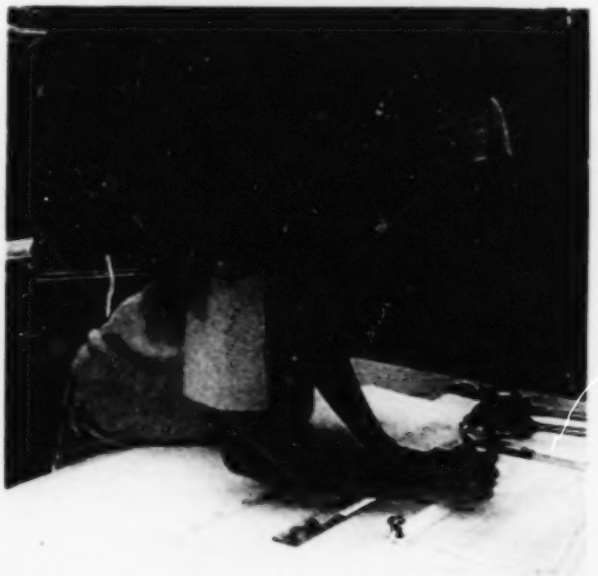
C.4.3 Use tools and materials to design, develop, or improve products that satisfy human wants and needs

C.4.4 Explain why people work collaboratively to design and produce products

C.4.5 Approach problem and opportunity situations given a set of constraints and illustrate possible solutions using basic design principles

C.4.6 Demonstrate simple problem-solving strategies

C.4.7 Develop abilities in technological design and engineering around simple constraints



BY THE END OF GRADE 8 STUDENTS WILL:

C.8.1 Research and develop a set of solutions to solve a problem not knowing all constraints

C.8.2 Explain and demonstrate several solutions to a problem or opportunity using technological design, tools, careful planning, experimentation, and testing

C.8.3 Brainstorm and illustrate ways to integrate efficiency into design through the reuse of materials, resources, and waste in technological systems

C.8.4 Predict possible outcomes of a newly designed technological system

C.8.5 Explain the value of technical knowledge and teamwork in the development of a device or process

C.8.6 Explain how changing the physical characteristics of material or the format of information can increase its usefulness

BY THE END OF GRADE 12 STUDENTS WILL:

C.12.1 Implement and evaluate strategies to solve technological problems that are likely to be successful

C.12.2 Measure, collect, and analyze data in order to solve a technological problem

C.12.3 Defend solutions to technological problems and opportunities

C.12.4 Select materials and other resources for a technological design and develop practical solutions

C.12.5 Identify constraints present in a given technological processes

C.12.6 Design and/or create solutions that are functional, aesthetically pleasing, demonstrate quality, have value greater than the investment, and meet a societal want or need

C.12.7 Present a design solution that accounts for production of a device; how the device would be operated, maintained, replaced, and disposed of; and, who will sell and manage it

C.12.8 Know that design solutions may have effects that were not predicted

C.12.9 Apply basic engineering concepts in the design and creation of solutions to various problems or opportunities

C.12.10 Evaluate a technological solution and make necessary improvement if needed

C.12.11 Select and apply appropriate processes to alter the characteristics of material to make it useful in different situations

D. IMPACT OF TECHNOLOGY

CONTENT STANDARD

Students in Wisconsin will understand that technology affects society and the environment in ways that are both planned and unplanned and desirable and undesirable.

Rationale: People develop and use technology to enhance their quality of life. Technologies like the automobile, nuclear power, genetic engineering, and factory automation have enhanced our mobility, enabled us to harness new energy resources, increased food production, reduced disease, and freed people from tedious or dangerous tasks. While each of these technologies has very distinct advantages, they also have clear disadvantages that need to be weighed carefully by those who live in a technological society. Given the rapid growth in technological capability, it is important that every citizen take an active role in promoting the common good by making informed decisions about risks and benefits of technology. To be active citizens, students need to understand the positive and negative impacts of technology on society and the environment. They need to weigh carefully the benefits and risks of technologies, and make informed decisions about technological issues.

PERFORMANCE STANDARDS

▶ *BY THE END OF GRADE 4 STUDENTS WILL:*

D.4.1 Identify new problems which result from using tools, materials, and processes to solve existing problems

D.4.2 Explain how given technologies make life and work easier, but also how they may make them more complicated

D.4.3 Identify instances where technologies have had benefits and applications that no one predicted when they were first invented

D.4.4 Evaluate and explain the impact people have had on the earth, including plant and animal life, through the development and introduction of technologies

D.4.5 Identify the advantages, disadvantages, risks, and benefits of given technologies

BY THE END OF GRADE 8 STUDENTS WILL:

D.8.1 Explain the difficulty in predicting the effects a new technology will have on society and the environment due to a lack of experience with the technology

D.8.2 Explain the importance of making projections, studying scenarios, and making thoughtful decisions because of the direct and indirect effects technology will have on the future

D.8.3 Contrast the advantages and disadvantages of given technology and make adjustments or develop new technologies if disadvantages outweigh the advantages

D.8.4 Explain why people must think about how a new technology might affect other people, societies, and the ecosystem in which we live

D.8.5 Explain that people can control the technologies they develop and use and that people are responsible for the effects their technology has on society and the environment

BY THE END OF GRADE 12 STUDENTS WILL:

D.12.1 Evaluate technologies based upon various sources of information

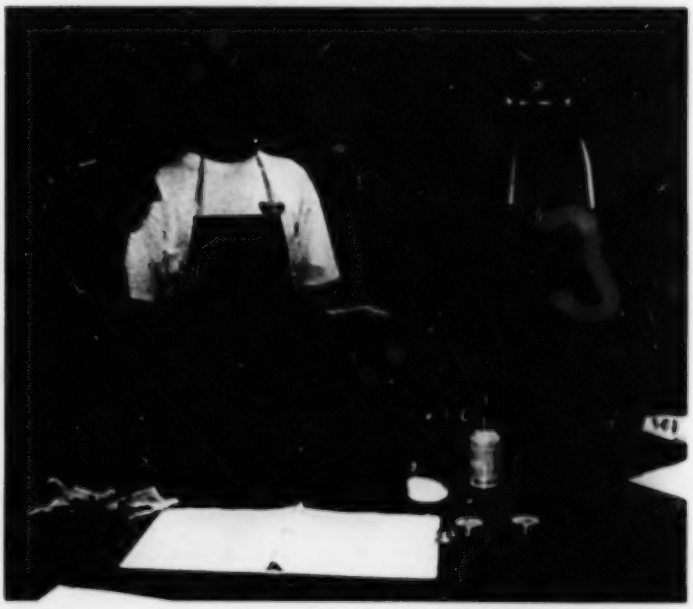
D.12.2 Illustrate how a technology can become controversial when people think the cost of the technology is not being equally shared by those who will benefit most from the technology

D.12.3 Analyze how the values and beliefs of different people can influence their perceived risks and benefits of a given technology

D.12.4 Evaluate the relative appropriateness of a given technology by comparing the risks with the benefits or the advantages with the disadvantages

D.12.5 Describe the current challenges and project the future challenges of governing a technology once it has become an integral part of the way people live, work, and play

D.12.6 Show how the effects of a given technology may be unacceptable under one set of circumstances but acceptable under a different set of circumstances



Glossary of Terms

Concepts. Important ideas. Concepts have a lasting quality. Once learned, concepts have a usefulness that can be transferred and applied in new and different situations.

Educational Technology. Devices and systems used to deliver education; generally communication technology equipment and the associated processes.

Educational technology is the method by which education (subject matter) is delivered. In the case of technology education, technology is the content of the field and a method of delivery.

General Education. "General education is general in several clearly identifiable ways: it is not directly related to a student's formal technical, vocational, or professional preparation; is part of every student's course of study, regardless of his or her area of emphasis; it is intended to impart common knowledge, intellectual concepts, and attitudes that every educated person should possess." (North Central Association of Colleges and Secondary Schools)

School to Work Transition. A program of experiences designed to provide enhanced career exploration, rigorous school-based learning, hands-on work experience, and partnerships between business and education.

Systematically. The ability of a student to develop and carry out a step-by-step procedure to reach a desired result.

Technical Education. A program of studies that leads to the preparation of a technician. This is usually a college function (technical college).

Technology. "The generation of knowledge and processes to develop systems that solve problems and extend human capabilities." (*Technology for All Americans*, 1996)

Technological Literacy. An ability to initiate and conduct activity associated with technological processes, systems, problems, opportunities, history, future, impact, ethics and consequences.

Technology Education. A program of studies that leads to technological literacy.

Vocational Education. A program of studies that leads to the preparation of workers with skills for specific occupations. This is usually a post-secondary function.

Bibliography

Kaku, Michio. *Visions: How Science Will Revolutionize the 21st Century*. New York: Anchor Books, 1997.

Mayr, Ernst. *Toward a New Philosophy of Biology: Observations of an Evolutionist*. Cambridge, MA: Belknap Press of Harvard University Press, 1988.

National Research Council. *National Science Education Standards: Observe, Interact, Change, Learn*. Washington, DC: National Academy Press, 1996.

Negroponte, Nicholas. *Being Digital*. New York: Knopf, 1995.

Project 2061, American Association for the Advancement of Science. *Benchmarks for Science Literacy*. New York: Oxford University Press, 1993.

Tapscott, Don. *The Digital Economy: Promise and Peril in the Age of Networked Intelligence*. New York: McGraw-Hill, 1996.

Technology for All Americans Project, International Technology Education Association. *Technology for All Americans: A Rationale and Structure for the Study of Technology*. Reston, VA: International Technology Education Association, 1996.

Notes

ISBN 1-57337-066-5